

Characterization of antenna array phase center for interferometric applications

Bijan Houshmand
Jet Propulsion Laboratory
California Institute of technology
4800 Oak Grove Drive
Pasadena, CA 91109-8099 U.S.A.
bh@athena.jpl.nasa.gov

Synthetic aperture radar (SAR) systems employ phase array antennas as an antenna element of the synthetic aperture. X-Band, C-band, and L-band phased array patch antennas have been used for SAR systems. For interferometric applications, the phase difference among multiple SAR measurements are used for reconstruction of topography or change detection. From a design and performance point of view, it is desired that the antenna phase center remains constant. The phase difference among measurements can then be related to surface topography and change. For accurate interpretation of the interferometric SAR (IFSAR) measurements, the phase center behavior of the SAR phased array as a function of the radar frequency bandwidth and scan angle needs to be characterized. The frequency bandwidth is related to the SAR spatial resolution in the slant-range direction. The scan in the range direction is used to provide a wider swath during a single pass measurement. Scanning capability along the direction of the synthetic aperture is used to align antenna beams for interferometric measurements. The required accuracy on the location of the phase center is typically at millimeter level. Current operational IFSAR systems use ground control points to calibrate the phase center separation among the synthesized apertures. Evaluation of the phase center characteristics is useful for application where antenna parameters vary over a wide range, and calibration information is not available. In this talk, analysis for computation of the phase center position for a 16-elements patch antenna array at C-band is presented. The FDTD algorithm is used to compute the near field of the antenna array. The phase center is computed by transforming the field information to the far field. In order to evaluate the mutual coupling effects on the phase center location, the near field of the 16-element array is computed in the presence of neighboring arrays. In this talk the computed results are compared with the antenna measurements of an antenna element which will be used for the Space Shuttle Topography Mission.